Technology on seed production and culture of Indian pompano - A new potential candidate fish for coastal aquaculture and mariculture

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Species diversification is considered as an important means to enhance the aquaculture production. Pompanos *(Trachinotus carolinus* and *T. blochii*) are globally recognized as promising candidate species for mariculture because of their attractive appearance, fast and uniform growth rate, adaptability to culture environment, acceptability to formulated feed, firm white and tasty meat with high market demand. The broodstock development and seed production techniques for both florida pompano (*Trachinotus carolinus*) and silver pompano (*Trachinotus blochii*) was well established globally by the 1980s. Subsequently, farming technology for both was standardized and perfected. Presently, the aquaculture of pompano is being successfully practised in many Asia – Pacific countries like Taiwan and Indonesia.

Indian pompano (*Trachinotus mookalee*) belonging to the family Carangidae (jacks and pompanos) is a potential candidate species for marine and brackishwater aquaculture in India. It is reported to grow to a size of 90 cm in total length and upto 8.1 kg body weight. In offshore cages, when cultured for 9 months under captivity, the fish grew from 42.8 g to 969.90 g (Ranjan *et al.*, 2017, *Prioritized species for mariculture in India*, ICAR-CMFRI, Kochi, 450 p.). As the wild catch of Indian pompano is very low, the existing high demand for this fish among consumers can only be met through aquaculture. Realizing this the Visakhapatnam Regional Centre of ICAR-Central Marine Fisheries Research Institute has now developed broodstock, induced bred and produced larvae of the Indian pompano, for the first time in the world.

Broodstock Development

Juveniles of Indian pompano weighing on an average 45.1 g were collected using cast nets from the coast off Visakhapatnam and raised in RCC tanks fitted with Recirculatory Aquaculture System (RAS) for grow-out to adults. After 21 months of rearing, they reached an average weight of 2.84 kg and length of 47.6 cm and were then used as broodstock. During the grow-out phase, there were initially fed on artificial pelleted feed, after which they were fed progressively on low value fishes, squid meat and clam and oyster meat, respectively at 6 – 10% of biomass, twice a day.

For broodstock development, 18 fish in sex ratio (female: male) of 1:2 were selected and stocked in 125 t capacity circular RCC tank fitted with RAS for broodstock development. The fishes were individually tagged with a tag transponder (PIT TAG FS 2001) for identification and for maintaining a record of their gonadal development. The fishes were continually fed on fresh squid and clam meat twice (0900 and 1530 hours) in a day till satiation. Additionally, various vitamins namely, vitamin A (25,000 IU), vitamin B-complex, vitamin C (500 mg), vitamin E (400 mg) and vitamin–mineral mix were supplemented twice a week along with the feed to avoid any possible nutritional deficiencies in their diet. Excess feed was removed from the bottom of the tank after 30 minutes. Gonadal maturity was assessed fortnightly by live gonadal biopsy using a flexible catheter of 1 mm inner and 2 mm outer diameter. Biopsy was performed by anaesthetizing the fish using 200 ppm of 2-phenoxyethanol for 2 minutes or until the opercular movement was

significantly reduced and then the fishes were cannulated to collect the gonadal tissue. The collected gonadal tissues were examined under a trinocular microscope with in-built photo-imaging system for morphometric analysis. Female oocyte development in Indian pompano is synchronous batch-type. One set of eggs of similar size was seen to develop synchronously, ready to spawn. Even before this set was spawned, immature oocytes were visible in the ovary samples. The numbers of immature oocytes was much higher than that of mature oocytes. Some medium-sized maturing oocytes were also visible; however, their numbers were very few. Final stage of vitellogenesis was observed in oocytes larger than 350 µm, which is marked by large opaque mass in the oocytes. The maximal vitellogenic oocyte diameter was 570 µm. Fish in the final stages of vitellogenesis with more than 500 µm were considered as mature The male became ripe after attaining 3.0 kg and were found to ooze milt on applying slight pressure to the abdomen.

The physiochemical parameters such as salinity (31.35 ppt), temperature (29.33 °C), dissolved oxygen (4.64 ppm), free carbon dioxide (0.18 ppm), total ammonia nitrogen (TAN) (0.037 ppm), nitrite (0.003 ppm), alkalinity (102.40 ppm) and pH (7.98) of the tank water were analyzed weekly and were found to be optimal for gonadal development, maturation and spawning.

Spawning induction and egg collection

Three induction trials with the same sex ratio were attempted for induced breeding of Indian pompano. Mature females containing vitellogenic oocytes with mean diameter larger than 500 µm and oozing males were selected for induction. Sex ratio (female to male) for induced spawning trial was 1:2. Females and males were injected with a single dose of human chorionic gonadotropin (hCG) at the rate of 350 IU kg^{-1} body weight and were stocked in the same tank for spawning. Spawning occurred within 36-38 hours (h) of induction at an average temperature of 29 °C. The spawned eggs from the broodstock tank were collected by passing the surface water through an egg-collecting chamber fitted with a hapa of 500 µm. While collection, eggs get sieved in the hapa, and then, the accumulated eggs were collected through a scoop net and treated with 20 ppm iodophore for 10 minutes and were finally stocked in 1 t FRP tank for hatching. Fertilization and hatching rate of the three spawning trials were estimated and were used as indicators for egg quality. Average fertilization rate was 69%. Fertilized eggs were differentiated from unfertilized eggs based on the colour. The embryonic development in fertilized eggs makes them transparent, whereas unfertilized eggs are opaque in colour. The size of the fertilized eggs of Indian pompano was 950-1000 µm which hatched after 18-20 h of incubation at temperature of 29 °C (Fig. 1). Average hatching rate was 87.67%.

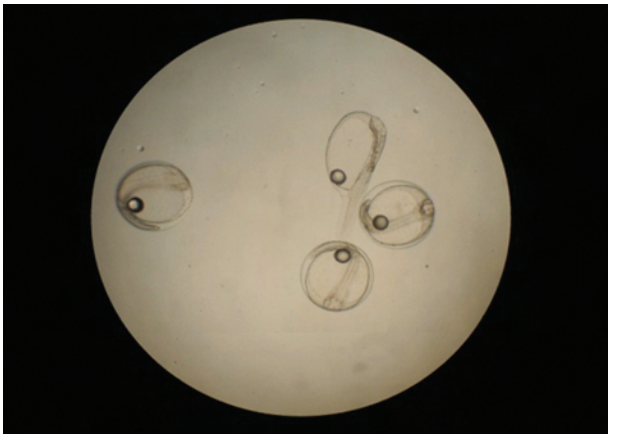

Fig. 1. Hatching of fertilized egg of Indian pompano in progress

Larval rearing

The hatched out larvae were stocked in 2 t circular FRP tank with 1 t sea water at the rate of 10 numbers per liter. The tank was provided with one central air stone with mild aeration. Larviculture was carried out using green water technique by employing different microalgae viz., *Nannochloropsis oculata* and *Isochrysis galbana* in 3:1 ratio @ 1 x 10^5 cells /ml. The morphological development of *T. mookalee* prior to metamorphosis was similar to that of other pompano species such as *T. blochii* (Abdul Nazar *et al.*, 2012, *Ind. J. Fish.*, 59(3): 83 -87). The newly hatched larvae were 2.12 ± 0.02 mm in total length with an oval shaped yolk

sac of 0.55 mm^2 and an oil droplet of 0.06 mm in area. The body length increased to 2.58 mm on 1st DPH while the yolk sac decreased to 0.06 mm^2. By 46 h post hatch, the yolk sac was almost absorbed, the eyes started to show visible pigmentation and mouth opened with a mouth gape of around 228.10 ± 1.31 μm. Enriched rotifers screened with 100 μm net and copepod nauplii were utilized as the initial feed during this stage. The yolk sac was completely absorbed by 3rd DPH, when the larval body length was about 2.66 ± 0.03 mm. Larval body length reached about 4.64 ± 0.3 mm by 6th DPH. By this time, the amount as well as size of rotifers given was increased to satisfy the feed demand. Larval body length reached about 6.35 ± 0.02 mm by 8th DPH, with the appearance of the dorsal, caudal and pelvic fins. At this stage, enriched *Artemia* nauplii were fed to the larvae to grow faster. The larvae reached about 9.04 ± 0.06 mm by 10th DPH, by this time, all fin types were well demarcated. Melanin pigmentation started from embryo development onwards which became intense as the larvae grew. Therefore, larvae body colour was dark till this stage. Artificial formulated feed was fed to the larvae from 12th DPH, when larval body length reached about 11.91 ± 0.07 mm. Larvae started metamorphosis by 17th DPH onwards, when larval body length reached 20.55 ± 0.08 mm and metamorphosis was completed by 21st DPH, when larvae reached 27.33 ± 0.10 mm. The larval body colour changed from dark to silvery on completion of metamorphosis. The juveniles developed the entire components of all fins and fed on artificial pellets of 0.8 mm (Fig. 2). After 24 days of culture, length of the larvae increased to 32.8 mm. Specific growth rate per day estimated for Indian pompano during larval rearing was 11.4% which was found to be higher than that reported (8%) for *T. blochii* (Abdul Nazar *et al.*, 2012 *Indian J. Fish.*, 59(3):83-87).

Fig. 2. Metamorphosed larvae of Indian pompano

Larval rearing protocol developed for successful seed production is depicted in Fig. 3. The physiochemical parameters such as salinity, temperature, dissolved oxygen, total ammonia nitrogen (TAN) and nitrite of the tank water were estimated daily and maintained at the optimum level required for the larval rearing of marine finfish. Artificial lighting of 700-800 lux was provided to the tank by fixing fluorescent tube over the tank for duration of 14-16 h. During the larval rearing, an average survival rate of 21.53% was achieved till complete metamorphosis, which is a first record globally for *T. mookalee*. Critical period for larval survival in Indian pompano was between 5th and 6th DPH, when the larval mortality was observed in rotifer fed larvae. However, this has reduced significantly after feeding the larvae with copepod nauplii. In these rearing experiments, a systemic and overlapping regime of live feeds beginning from copepod nauplii and rotifer to *Artemia* and artificial pellets were utilized. The adequate supply of live feeds meeting nutritional requirements, as has been developed, holds the key for improving survival rates of *T. mookalee* larvae in future.

Nursery rearing and grow-out

Nursery rearing of Indian pompano was standardized with different feed and culture conditions. In rearing tanks, when nursed for a period of two months at a density of 150 numbers/m^3, fry weighing on an average 3.95 g reached 28.08 g with a weight gain percentage of 610. Fry were fed artificial pelleted feed containing 45 % protein and 10% fat during this period @ 10% of biomass four times a day. In ponds, Indian pompano fry weighing on an average 2 g were nursed in hapas at a density of 150 numbers/m^3 and the fry attained a weight of 20 g after 60 days of rearing. The feeding regime followed was similar. The produced fingerlings were either used for grow-out in ponds or were distributed to private entrepreneurs in

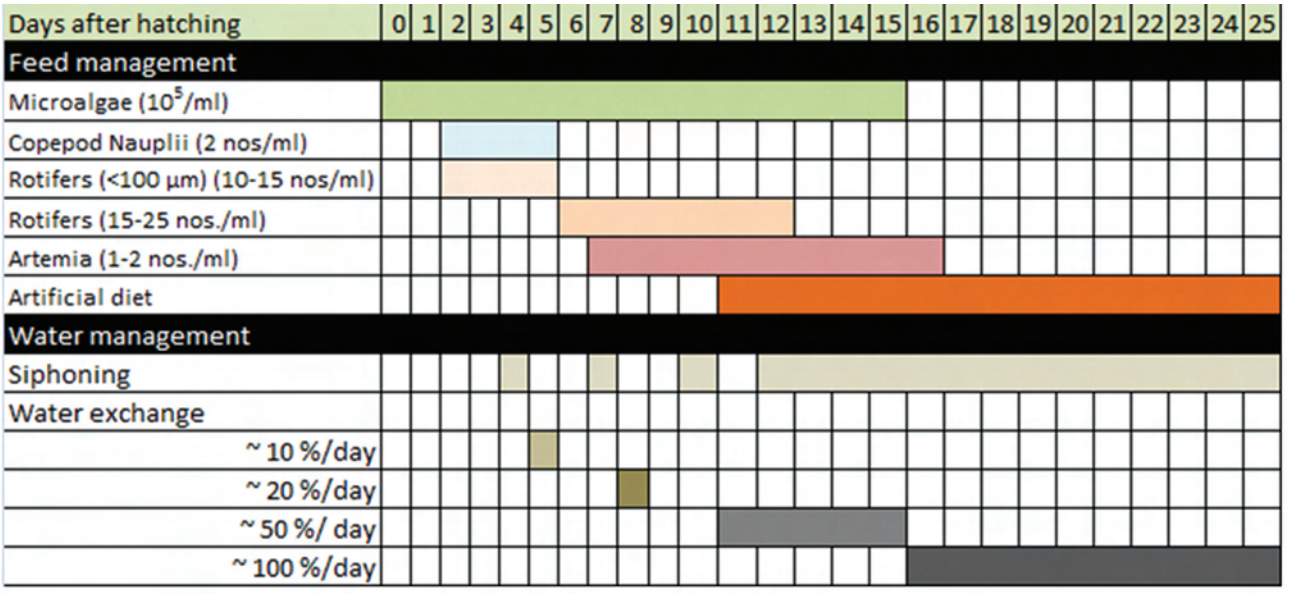

Fig. 3. Standardized feeding and water management protocol developed for larval rearing of Indian pompano

Andhra Pradesh. For stocking in ponds, advanced fingerlings of approximately 20 g size is ideal. Optimum stocking density for pond grow-out culture is 1 number/m^3. The fishes were fed with artificial pelleted feed having 40 % protein and 10 % fat @ 5-8% of biomass thrice a day. Aeration in the pond was an absolute necessity. Indian pompano reached 27.8 cm and 335 g after nine months of grow-out.

Nursery rearing and grow-out was carried out in marine cages (HDPE of 6 m in diameter) using hatchery produced seeds. Seeds weighing 2.5 g and measuring 5.25 cm were stocked at 35 nos/m^3 in 6m diameter HDPE cages with 8 mm mesh size inner net. Initially fish fingerlings were fed at 10% of body weight with commercial floating diet containing 45% crude protein and 10% fat twice a day. On attaining an average of 50 g body weight, the fishes were fed with floating pellets having 40% crude protein and 10% fat. The fishes were maintained at the same stocking densities till they reached an average body weight of 280 g after six months of rearing and thereafter, the fishes were stocked into two different stocking densities i.e. 15 and 20/m^3 in two different 6 m HDPE cages with inner net of 2.5 cm mesh size. Henceforth, fishes were fed with low valued finfishes (sardine, scad and tilapia) at 8-10% of body weight twice a day for a culture period of another six months. During the initial six months of rearing, fishes grew from 2.5 g to 280 g with an average FCR of 1.0:1.29 on artificial pelleted feed. In the next six months of culture, fishes stocked at 15/m^3 reached to 769 g with a calculated FCR of 1.0:4.98. The fishes stocked at 20/m^3 reached 478 g with a calculated FCR of 1.0:7.48 (Fig. 5). Specific growth rate for the fishes stocked at 15/m^3 and 20/m^3 were 1.83% and 1.69 % per day, respectively with an average survival of 93.6%. It was observed that feed acceptance of the fish for pelleted feed and low valued fishes were equally good. However, among low valued fishes, acceptance for sardine and Indian scad was comparatively better than tilapia.

Fig. 4. Indian pompano cultured in cage